CLAIMS

What is claimed is:

1. A coated piston assembly component, comprising:

a piston assembly component having a substrate surface; and

a textured coating on the surface of the substrate, the coating formed of a dry powder coating composition including a thermoset resin having a cure temperature combined with at least 5 volume percent filler based on the volume of the powder coating, wherein the filler is formed of a material which does not melt substantially at or below the cure temperature of the resin, the powder coating having a structure such that the coating has from about 20 to about 90% mass of its geometrically theoretically calculated mass, whereby an abradable coating results employing the filler which makes the coating abradable.

2. The coated piston assembly component according to claim 1, wherein the thermoset resin is selected from the group consisting of acrylic, polyester, epoxy, allyl, melamine formaldehyde, phenolic, polybutadiene, polycarbonate, polydicyclopentadiene, polyamide, polyamide imide, polyurethane, silicone, and combinations thereof.

3. The coated piston assembly component according to claim 1, wherein the filler is employed in an amount of at most about 45 volume percent based on the volume of the resultant composite powder composition.

4. The coated piston assembly component according to claim 1, wherein the filler is employed in an amount of from about 15 to about 30 volume percent based on the volume of the resultant composite powder composition.

5. The coated piston assembly component according to claim 1, wherein the coating is employed non-continuously of the composite powder composition.

6. The coated piston assembly component according to claim 1, wherein the filler is selected from the group consisting of metals, silicates, graphite, boron nitride, diamond, molybdenum disulfide, fluorides, clays, dirt, wood, ash, pigments, ceramics, polymers, silicon

dioxide, titanium dioxide, gypsum, phosphorescent materials, cured resin systems, cured composite powder compositions, and mixtures thereof.

7. The coated piston assembly component according to claim 1, wherein the dry composite powder composition further contains a polymeric material selected from the group consisting of polymers, non-activated thermoset resin, thermoplastics and polymer waxes.

8. The coated piston assembly component according to claim 7, wherein the powder composition further contains a polymer wax selected from the group consisting of fluoropolymer wax, polyethylene wax and polypropylene wax.

9. The coated piston assembly component according to claim 1, wherein the coating powder composition further contains a foaming agent that is gas-producing when heated, such that the coating includes gas voids with ligament walls after curing.

10. The coated piston assembly component according to claim 1, wherein the textured coating has a roughness Ra value of from about 1 to about 2000 microinches.

11. The coated piston assembly component according to claim 1, wherein the textured coating has an Rsk value of from about 10 down to about –150.

12. The coated piston assembly component according to claim 1, wherein the textured coating is coated to a thickness of from about 5 to about 250 micrometers thick.

13. The coated piston assembly component according to claim 12, wherein the textured coating is coated to a thickness of from about 15 to about 80 micrometers thick.

14. A coated piston assembly component, comprising:

a piston assembly component having a substrate surface; and

a textured coating on the surface of the substrate, the coating formed of a dry powder coating composition including an uncured thermoset resin having a cure temperature, wherein the thermoset resin is selected from the group consisting of acrylic, polyester, epoxy, allyl, melamine formaldehyde, phenolic, polybutadiene, polycarbonate, polydicyclopentadiene, polyamide, polyamide imide, polyurethane, silicone, and combinations thereof, in combination with a second component, including at least 5 volume percent filler

based on the volume of the resultant composite powder composition, wherein the filler is formed of a material which does not substantially melt at or below the cure temperature of the resin, and wherein the filler is selected from the group consisting of metals, minerals and mineral substances having MOH's of between 0 and 10, silicates, graphite, boron nitride, diamond, molybdenum disulfide, fluorides, clays, dirt, wood, ash, pigments, ceramics, polymers, silicon dioxide, titanium dioxide, gypsum, phosphorescent materials, cured resin systems, cured composite powder compositions, and mixtures thereof; and

a polymeric material selected from the group consisting of polymers, non-activated thermoset resin, thermoplastics and polymer waxes selected from the group consisting of fluoropolymer wax, polyethylene wax and polypropylene wax,

whereby an abradable coating results on the piston assembly component, and said coating employing the filler which makes the coating abradable.

15. A method of making a composition for coating a piston assembly component with a coating curable into an abradable coating, comprising:

melt-mixing an evaporative carrier-free mixture of a dry powder thermoset resin having a cure temperature, and at least 5 volume percent of filler, based on the volume of the resultant composite powder composition, to form a mass composite, wherein the filler is formed of a material which does not substantially melt at or below the cure temperature of the resin;

cooling the mass composite; and

breaking the cooled mass composite into powder particles, thereby forming the composite powder composition.

16. The method according to claim 15, further comprising consolidating the resin and the filler together into small units before the melt-mixing step.

17. The method according to claim 15, further comprising:

consolidating the resin and the filler together into small units; and

mixing a hardener with the small units before the melt-mixing step.

18. The method according to claim 15, wherein the resin is selected from the group consisting of acrylic, polyester, epoxy, allyl, melamine formaldehyde, phenolic, polybutadiene, polycarbonate, polydicyclopentadiene, polyamide, polyamide imide, polyurethane, silicone, and combinations thereof.

19. The method according to claim 15, wherein the filler is employed in an amount of at most about 45 volume percent based on the volume of the composite powder composition.

20. The method according to claim 15, wherein the filler is employed in an amount of from about 15 to about 30 volume percent based on the volume of the resultant composite powder composition.

21. The method according to claim 15, further comprising:

consolidating the resin and the filler together into small units; and

mixing a silicone resin and an epoxy amine adduct with the small units before the melt-mixing step.

22. The method according to claim 15, wherein the filler is formed of a material selected from the group consisting of metals, minerals and mineral substances having MOH's of between 0 and 10, silicates, graphite, diamond, molybdenum disulfide, fluorides, clays, dirt, wood, ash, pigments, ceramics, polymers, silicon dioxide, titanium dioxide, gypsum, phosphorescent materials, cured resin systems, cured composite powder compositions and mixtures thereof.

23. A method of making a composition for coating a piston assembly component with a coating curable into an abradable coating, comprising:

melt-mixing an evaporative carrier-free mixture of a dry powder thermoset resin having a cure temperature, wherein the resin is selected from the group consisting of acrylic, polyester, epoxy, allyl, melamine formaldehyde, phenolic, polybutadiene, polycarbonate, polydicyclopentadiene, polyamide, polyamide imide, polyurethane, silicone, and combinations thereof, and at least 5 volume percent of filler, based on the volume of the resultant composite powder composition, wherein the filler is formed of a material which does not substantially melt at or below the cure temperature of the resin, and wherein the filler is formed of a material selected from the group consisting of metals, minerals and mineral substances having MOH's of between 0 and 10, silicates, graphite, diamond, molybdenum disulfide, fluorides, clays, dirt, wood, ash, pigments, ceramics, polymers, silicon dioxide, titanium dioxide, gypsum, phosphorescent materials, cured resin systems, cured composite powder compositions and mixtures thereof, to form a mass composite;

cooling the mass composite; and

breaking the cooled mass composite into powder particles, thereby forming the composite powder composition.

24. A method of making a composition for coating a piston assembly component with a coating curable into an abradable coating, comprising:

consolidating an evaporative carrier-free mixture of a dry powder thermoset resin having a cure temperature, wherein the resin is selected from the group consisting of acrylic, polyester, epoxy, allyl, melamine formaldehyde, phenolic, polybutadiene, polycarbonate, polydicyclopentadiene, polyamide, polyamide imide, polyurethane, silicone, and combinations thereof, together with at least 5 volume percent of a filler, said volume percent being based on the volume of the resultant composition, wherein the filler is formed of a material which does not substantially melt at or below the cure temperature of the resin, and wherein the filler is formed of a material selected from the group consisting of metals, minerals and mineral substances having MOH's of between 0 and 10, silicates, graphite, diamond, molybdenum disulfide, fluorides, clays, dirt, wood, ash, pigments, ceramics, polymers, silicon dioxide, titanium dioxide, gypsum, phosphorescent materials, cured resin systems, cured composite powder compositions and mixtures thereof, to form a consolidated resin-filler composition of small units;

melt mixing the small units of consolidated resin and filler composition to form a mass composite;

cooling the mass composite; and

breaking the cooled mass composite into powder particles, thereby forming a composite powder composition suitable for use as an abradable coating.

25. The method according to claim 24, further comprising:

consolidating the resin and the filler together into small units; and

mixing a hardener with the small units before the melt-mixing step.

26. A method of coating a piston assembly component with an abradable coating, comprising:

powder coating onto a piston assembly component a dry composite powder composition containing a powder mixture of a thermoset resin having a cure temperature and at least 5 volume percent of filler, based on the volume of the composite powder composition; and

curing the applied composite powder composition.

27. The method according to claim 26, wherein the resin is selected from the group consisting of acrylic, polyester, epoxy, allyl, melamine formaldehyde, phenolic, polybutadiene, polycarbonate, polydicyclopentadiene, polyamide, polyamide imide, polyurethane, silicone, and combinations thereof.

28. The method according to claim 26, wherein the filler is employed in an amount of at most about 45 volume percent based on the volume of the composite powder composition.

29. The method according to claim 26, wherein the coating is employed non-continuously of the composite powder composition.

30. The method according to claim 26, wherein the filler is employed in an amount of from about 15 to about 30 volume percent based on the volume of the resultant composite powder composition.

31. The method according to claim 26, wherein the filler is formed of a material selected from the group consisting of metals, minerals and mineral substances having MOH's of between 0 and 10, silicates, graphite, diamond, molybdenum disulfide, fluorides, clays, dirt, wood, ash, pigments, ceramics, polymers, silicon dioxide, titanium dioxide, gypsum, phosphorescent materials, cured resin systems, cured composite powder compositions and mixtures thereof.

32. A method of coating a piston assembly component with an abradable coating, comprising:

applying, to a piston assembly component, a dry composite powder composition containing a powder mixture of a thermoset resin having a cure temperature and at least 5 volume percent of filler, based on the volume of the composite powder composition; and

curing the applied composite powder composition.

33. The method according to claim 32, wherein the step of applying is accomplished by electrostatic powder coating.

34. The method according to claim 32, wherein the step of applying is accomplished by electrostatic fluidized bed coating.

35. The method according to claim 32, further comprising masking off certain portions of the piston assembly component prior to applying the dry composite powder composition to the surface of the piston assembly component.

36. The method according to claim 32, further comprising air knifing off certain portions of the dry powder application to the surface piston assembly component prior to curing the dry composite powder composition onto the surface of the piston assembly component.

37. The method according to claim 32, further comprising vacuuming off certain portions of the dry powder application to the surface piston assembly component prior to curing the dry composite powder composition onto the surface of the piston assembly component.

38. The method according to claim 32, further comprising air spraying off certain portions of the dry powder application to the surface piston assembly component prior to curing the dry composite powder composition onto the surface of the piston assembly component.

39. The method according to claim 32, wherein the step of curing is accomplished by heating by a method selected from the group consisting of an oven, infra-red heaters, convection heaters, induction heating, radiant heating, open torch flames, and localized open flame application.

40. The method according to claim 32, further comprising an additional step of modifying the uncured powder coating on the piston assembly component before curing the coating, where by the uncured powder coating is pushed into a desirable configuration.

41. The method according to claim 32, further comprising an additional step of partially heating and curing the coating to allow working of the uncured powder coating on the piston assembly component to achieve a desired configuration, followed by further heating to fully cure the resin until hard.